

LIGHT EMITTING DIODES WITH IMPROVED LIGHT EXTRACTION EFFICIENCY

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ABSTRACT OF THE DISCLOSURE

Light emitting devices with improved light extraction efficiency are provided. The light emitting devices have a stack of layers including semiconductor layers comprising an active region. The stack is bonded to a transparent optical element having a refractive index for light emitted by the active region preferably greater than about 1.5, more preferably greater than about 1.8. A method of bonding a transparent optical element (e.g., a lens or an optical concentrator) to a light emitting device comprising an active region includes elevating a temperature of the optical element and the stack and applying a pressure to press the optical element and the light emitting device together. A block of optical element material may be bonded to the light emitting device and then shaped into an optical element. Bonding a high refractive index optical element to a light emitting device improves the light extraction efficiency of the light emitting device by

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reducing loss due to total internal reflection. Advantageously, this improvement can be achieved without the use of an encapsulant.